By Steve Werblow

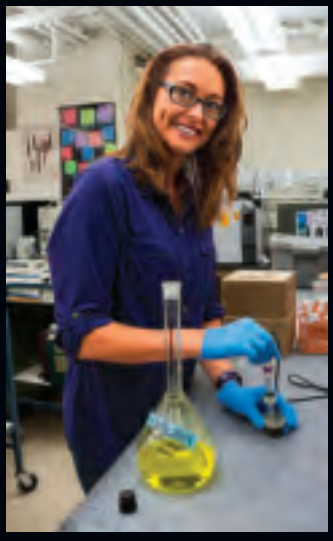
Acid test

Falling pH raises many questions

Plummeting pH levels in Washington, Oregon, and Idaho are providing hard lessons on acid soils for farmers there, and could shed new light on pH management for growers everywhere.

More than 50 years of using ammonia fertilizers has acidified the upper few inches of the naturally neutral soils of the legendary Palouse region. As farmers are becoming aware of the problem, many must consider liming.

That's something their fathers and grandfathers never had to do, notes Carol McFarland, a graduate student at Washington State University who is at the forefront of the effort to understand and manage the region's pH crash. Her message: soil chemistry is strongly influenced by pH and affects every aspect of farm management.



"Soil pH is one of the master variables," McFarland explains. "It has a cascading effect on soil chemistry."

Because the area's acidity is a man-made problem, it is concentrated where fertilizer has been applied, she

►**Large photo:** After generations of ammonia fertilizer applications, pH has dropped dramatically in the upper inches of the naturally neutral Palouse soils. ►**Left:** Carol McFarland of Washington State University is studying the chemistry of soil acidification and liming in Palouse soils.

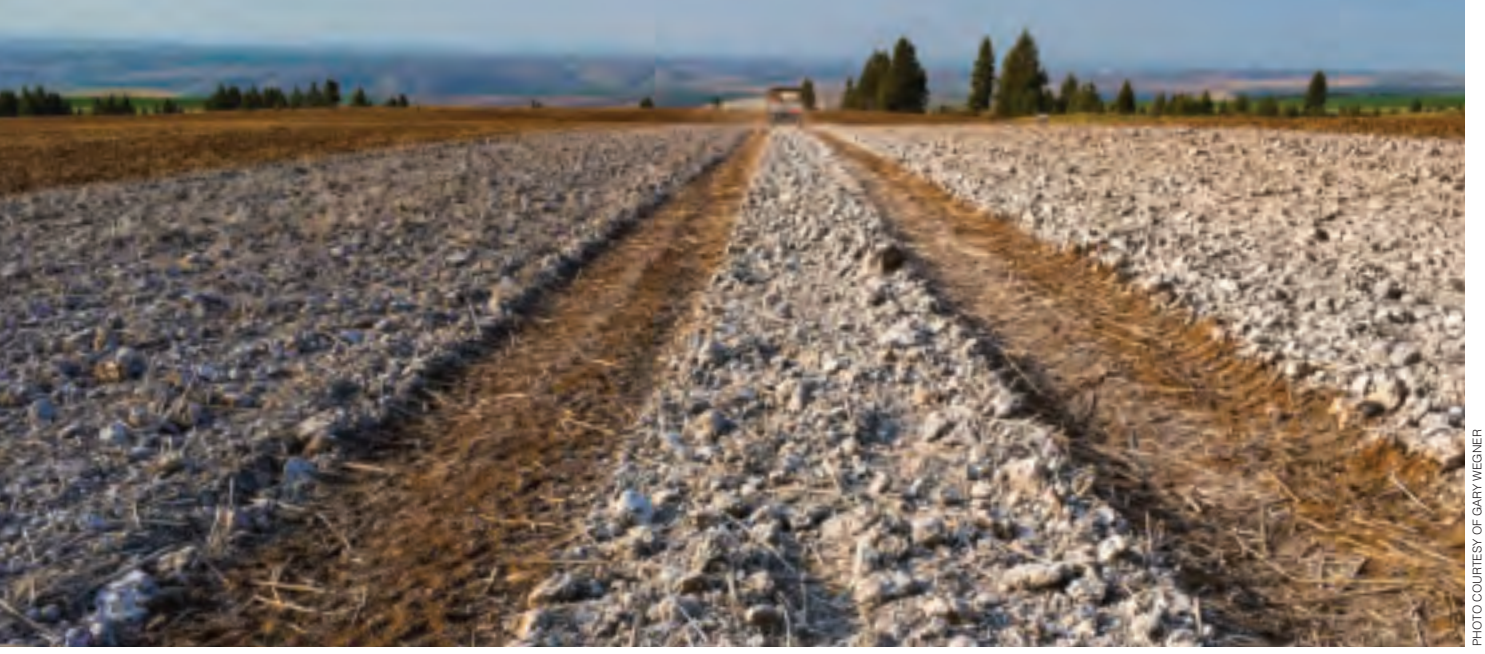


PHOTO COURTESY OF GARY WEGNER

►**Top:** NuCal delivers 4 trillion calcium carbonate particles per cubic inch. That renders lime scores based on 100-mesh ag lime outdated. ►**Above:** Gary Wegner (kneeling as he tests soil core pH) teaches John Bartels and Abby Strocscher of Columbia State Bank about the costs of acid soils.

adds. She and advisor David Huggins of USDA-ARS are studying 10 soils, charting their reactions to lime, exploring application methods for calcium carbonate, and studying pH levels at different depths. Because local soils have little ability to buffer pH changes, they are also calibrating buffer tests to estimate lime requirements.

Healthier soils. Meanwhile, colleagues like Kurtis Schroeder of the University of Idaho are studying the wide range of effects of pH on soil biota, root health, and plant disease.

"It all goes back to healthy soil," Schroeder says, checking a test plot.

Schroeder is also testing a range of calcium carbonate sources, hoping to develop programs that combine the speed of NuCal liquid calcium carbonate with the lower per-ton cost of slow-working ag or sugarbeet lime.

When he moved to eastern Washington from Indiana, Paul Carter of Washington State University Extension was surprised that local farmers didn't think about liming fields. When he collected soil samples across 150,000 acres and found that nearly 90% had pH levels below 5.2—and many in the 4s—in the top 6 inches of the soil, he knew there was trouble.

True, denial is part of the problem. But some of that dramatic acidity was also being disguised by traditional deep soil samples, he suspects. After all, if just the top 6 inches of soil are highly acid, mixing the low-pH layer with another foot or two of neutral soil would yield a more moderate—and acceptable—pH reading.

Stratified sampling. That's why Carter has become a proponent of taking stratified soil samples. He says precision soil sampling is about more than location: it's also about depth.

Carving off chunks of soil cores into buckets—different pails for 0 to 3 inches, 3 to 6 inches, 6 to 12 inches, and 12 to 24 inches—adds cost to soil testing, but provides vital insight.

Gary Wegner, a sales rep for lime manufacturer Columbia River Carbonates, demonstrates a shortcut. He lays a full soil probe on the tailgate of his pickup, wets the soil core, and stretches a measuring tape alongside it. Every inch, he touches a $160 pH meter to the soil, recording the reading as he goes: 5.17...5.36...5.85...6.45.

►**Above:** Pullman, Washington, growers John (left) and Drew Howell say liquid lime boosted plant health and protected wheat from winter kill.

That's bad news, he notes. At pH 5.0, just 34% of the phosphorus in the soil is available to roots, Wegner explains, and nitrogen availability is falling. Soil organisms—from nutrient-cycling fungi to nitrogen-fixing rhizobia—have died off. Meanwhile, toxic aluminum is being freed up in the soil. Herbicide efficacy and carryover are all out of kilter. If the pH drops to 4.7, the field's wheat crop would lose 32 percent of its yield potential before the first seed is even planted.

New insights. Acid layers could be holding back farmers worldwide, particularly where no-till or surface applications of N have concentrated ammonia in the seed zone. It's one of the reasons Washington State's Huggins is eager for thorough scrutiny.

"We've got more testimonials out there than we've got actual research," he says as data begins to flow. ■